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PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) APPARATUS FOR EFFECTING MEDICAL TREATMENTS WITH RADIO ACTIVE ISOTOPES

(71) We, NUCLESA-NUCLEAR ENGINEERING AND EQUIPMENT S.A., of Chemin des Palettes, 25, 1212 Grand-Lancy, Switzerland, a Swiss Body Corporate, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a novel apparatus for effecting medical treatments with the aid of radioactive isotopes.

The apparatus according to the invention is intended for use with isotopes which are in the form of a number of discrete dosage units; the apparatus comprises at least one tubular probe serving as an applicator for the isotope and wherein the isotope units are disposable in a row with or without the interposition of non-radioactive units, storage chambers for radioactive and non-radioactive units, conduits for allowing the movement of said units from the storage chambers to the or each probe and back to the storage chambers, means for controlling the type and number of each unit passed to each probe, and means for connecting a source of pressurised fluid to the conduits for causing at least part of said movement of the units.

The accompanying drawing represents by way of example one embodiment of the present invention:

Figure 1 is a perspective view thereof;

Figure 2 is a schematic view of its electro-pneumatic circuit.

Referring to Figure 1, the apparatus includes a carriage 1 mounted on wheels 2 and on the front side of which are secured six flexible conduits 3. One of the conduits is shown completely and carries at its extremity a probe 4 which makes it possible to carry out intra-uterine applications of radioactive isotopes.

A control panel 6 is connected through cable 5 to the front side of carriage 1 and enables the operator to control this apparatus from a distance, for example, from outside a shielded room in which are placed the beds of the patients and the apparatus itself

The rear face of the apparatus carries a bottle of compressed air 7 while the upper side has a panel 8 for programming the treatments which are to be carried out with the aid of the six probes secured on the previously mentioned conduits 3.

Different probe lamps and computers 9 make it possible to monitor at all times the correct functioning of the apparatus.

Figure 2 shows two of the programming lines of panel 8 which allow the disposition of the radioactive charges in two probes 4 to be controlled as will now be described.

On each of these lines, it is possible to place plugs f in corresponding sockets according to the programme which must be carried out. The presence or the absence of these plugs will correspond to the presence or the absence of radioactive balls in a series of balls which will be contained in the corresponding probe when the programme posted has been realised.

In the apparatus according to the invention, the distribution of radioactivity of the probe along its entire length is adjusted by disposing in this probe radio-isotopes alternating with bodies which are neutral from the point of view of radioactive emission. Both the radio-isotopes and the neutral material are shaped into balls, which are radioactive in the first case and of neutral (i.e. non radioactive) magnetizable material in the second. These balls all have the same diameter and are shown in black in the drawing in the case of the radioactive type while the others are shown as white.

The balls of each type are stored in separate tubular chambers, 10 and 11, disposed vertically side by side and the first of which is shielded, for example with lead.

These two chambers issue at their lower end each onto a corresponding housing 12a and 12b provided in a drawer 12 movable horizontally by means of an electro-magnet

[*Price 5s. 0d. (25p)*]

13 so as to carry housing 12a or 12b above a conduit 14 according to the data communicated by a reader 15 detecting the presence or absence of plugs f in the programming lines of panel 8. A relay 16 actuated by a detector 17 indicates that a ball has passed to drawer 12, in conduit 14 which causes reader 15 to move from one vertical column to another.

Conduit 14 issues above the opening of a flexible conduit 18, the lower end of which is attached to a movable member 19 and the upper end to a movable member 20.

Movable member 19 may be rotated by control means (not shown) from an inoperative position, shown in the drawing, in which all balls falling into conduits 18 would stop against a surface 18a, and thus not be able to continue its movement, until the tip of conduit 18 is aligned with conduit 21 leading to a first probe 4' or with a conduit 22 leading to another probe 4'', 4' and 4'' being two of the six probes 4 previously mentioned. The schematic arrangement shown in Figure 2 is limited to two probes only but it is evident that it can be readily extended to six probes or more.

Movable member 20 can bring the upper end of conduit 18 to coincide with the lower end of a conduit 23, the purpose of which is described later.

Conduits 21 and 22 are vertical and communicated at their lower end with horizontal conduits 24 and 25 forming intermediate spaces in which the radioactive or neutral balls are received before being directed towards probes 4' and 4'' through flexible conduits 3' and 3''. Conduits 24 and 25 are surrounded by lead shielding 26. It is in the intermediate spaces that the radioactive or neutral balls which are removed in accordance with the posted programme are stored before each series of balls is driven into a respective probe 4 by actuating the control panel 6, which the operator does when all the probes have been assigned to different patients and he has left the room where the apparatus is located.

As shown in Figure 2, each flexible conduit 3' or 3'' is formed of an inner flexible tube a having a diameter corresponding to that of the balls, surrounded by a flexible sheath b defining with this tube a channel having an annular cross-section. Probe 4' or 4'' is formed in the same way and is constituted by a flexible tube c enveloped by a sheath d. Each tube c has an opening at its free end e for the passage of air.

In the apparatus shown, the compressed air bottle 7 (Figures 1 and 2) can be connected through electrically actuated valves 27 and 28 to conduits 21 and 22 or through other valves 29 and 30 to the annular spaces defined by conduits a and b previously mentioned.

When compressed air is sent into conduits 21 and 22 and the radioactive or neutral balls are disposed in the horizontal spaces 24 and 25, these balls are then pushed by their pressure through the flexible conduits into probes 4.

If valves 27 and 28 are on exhaust and valves 29 and 30 are open, the compressed air penetrates then into inner tubes c of probes 4 through openings e and the balls are then driven from right to left in the drawing into conduits 24 or 25 and then into conduits 21 and 22.

The operation of valves 29 and 30 is effected automatically by timing devices 31. It is possible to adjust the moment that these devices come into play according to the duration of the treatment which is selected from case to case.

With the described apparatus, it is also possible not only to evacuate radioactive or neutral balls contained in the probes but also to return them into their respective storage chambers 10 or 11.

To do this it is necessary to move sector 20 in order to position the upper tip of flexible conduit 18 in front of the lower tip of conduit 23. This conduit leads to a vertical tube 32 into which the balls driven by compressed air and coming from probes 4 through conduits 18 stack up above a receiving housing 33 provided in the drawer 34 which is subjected at its extreme left to pressure from a spring 35 and at its extreme right to a cam 36 rotated by a motor 37.

This cam is arranged in such a way as to guide the movement of drawer 34 so that it moves perpendicularly to conduit 32 and conduits 10 and 11 and successively positions housing 33 over them. As described, the balls fall successively into housing 33 regardless of whether they are radioactive or neutral balls. It is advantageous then to separate these balls before they fall by gravity into conduit 10 when the housing 33 of drawer 34 is placed above the opening of these conduits.

Since the neutral balls are of magnetizable material, preferably of steel, this separation can be effected by placing above the tip of conduit 10 a magnet 38 which retains these balls and prevents them from falling into space 10 while the radioactive balls which are non-magnetizable can do so.

The magnetizable balls remaining in housing 33 can on the contrary, fall by gravity into space 11 as soon as they are situated above this space.

The invention is not limited to what has been shown in the drawing: in particular the electro-pneumatic circuit of the apparatus can comprise a pressure device controlling the expulsion of balls contained in the probes in the direction of the intermediate spaces 24 and 25 as soon as the pressure of the compressed air falls below a given value.

In the same manner this same expulsion

can be carried out in the case of a failure of the electrical power supply to the apparatus.

WHAT WE CLAIM IS:—

1. Apparatus for effecting medical treatment with a radioactive isotope which is in the form of a number of discrete dosage units, which apparatus comprises at least one tubular probe serving as an applicator for the isotope and wherein the isotope units are disposable in a row with or without the interposition of non-radioactive units, storage chambers for radioactive and non-radioactive units, conduits for allowing the movement of said units from the storage chambers to the or each probe and back to the storage hambers, means for controlling the type and number of each unit passed to each probe, and means for connecting a source of pressurized fluid to the conduits for causing at least part of said movement of the units.

2. Apparatus as claimed in claim 1, which includes at least two probes, and a programming member for each probe wherein said control means comprises a conduit portion which is movable according to the programming member so as to direct the units taken from the chamber towards one or other of the probes.

3. Apparatus according to claim 1 or 2 wherein each storage chamber has a tubular shape for receiving said units in the shape of balls and the longitudinal axis of each chamber is inclined to the horizontal, with a lower opening issuing upon a horizontal drawer having a housing for a ball issued thereinto, a motor member being provided to move the drawer in such a way as to position alternately each housing above a single inlet opening to the dispenser, in accordance with the programme for removal of said units.

4. Apparatus according to any one of the preceding claims, wherein said control means comprises a dispensing conduit with its upper end opposite said inlet opening and its lower end fixed to a movable member adapted to bring it in front of an inlet to a conduit associated with one or the other probe according to a selected distribution programme.

5. Apparatus to claim 4, wherein said dispensing conduit and the initial part of each conduit extend in vertical plane and are arranged in such a way that said units pass said control means and into the central part of the conduits under the action of gravity.

6. Apparatus according to claim 5, having at least one intermediate area for units positioned between said dispenser and said probe and arranged in such a way that the balls can remain stationary without rolling under the action of gravity, said area making it possible to store those balls which have already been assembled according to the stipulated programme.

7. Apparatus according to any preceding claim, wherein said probe is formed by a tube perforated at its free end and surrounded by a sleeve forming an annular channel with said tube, said channel being connectible to the source of compressed fluid with valves permitting all connection between said source and the network of conduits to be cut in order to make the units contained in the probe move back up into the conduits towards said control means.

8. Apparatus according to claim 7, as dependent on claim 4, wherein said dispensing conduit is attached to a movable member having means for moving it from a first position in which the dispensing conduit communicates with the drawer into a second position in which the conduit communicates with a recovery tube for units returning from the probe, and said recovery tube issues into a device for selecting the units of each kind and for distributing balls selected into the respective storage chambers.

9. Apparatus according to claim 8, for use with non-radioactive balls which are made of magnetisable material wherein the device comprises a distribution drawer having a housing from which the units successively fall one by one, this drawer being moved in such a way as to position this housing alternatively above the opening of each storage chamber, a magnet being placed opposite the opening of the chamber for the radioactive units in such a way as to prevent the fall of non-radioactive units into said chamber.

10. Apparatus according to any preceding claim, having timing means for checking the treatment time, these means being so arranged as to cause evacuation of the units contained in the probes in the direction of their respective chambers when said time is ended.

11. Apparatus according to any preceding claim having means for driving units contained in the probes into shielded areas intermediate the probe and storage chambers when the pressure of fluid reaches a predetermined minimum or when the apparatus is no longer supplied with electrical current.

12. Apparatus for effecting medical treatment with radioactive isotopes, substantially as hereinbefore described and shown in the accompanying drawings.

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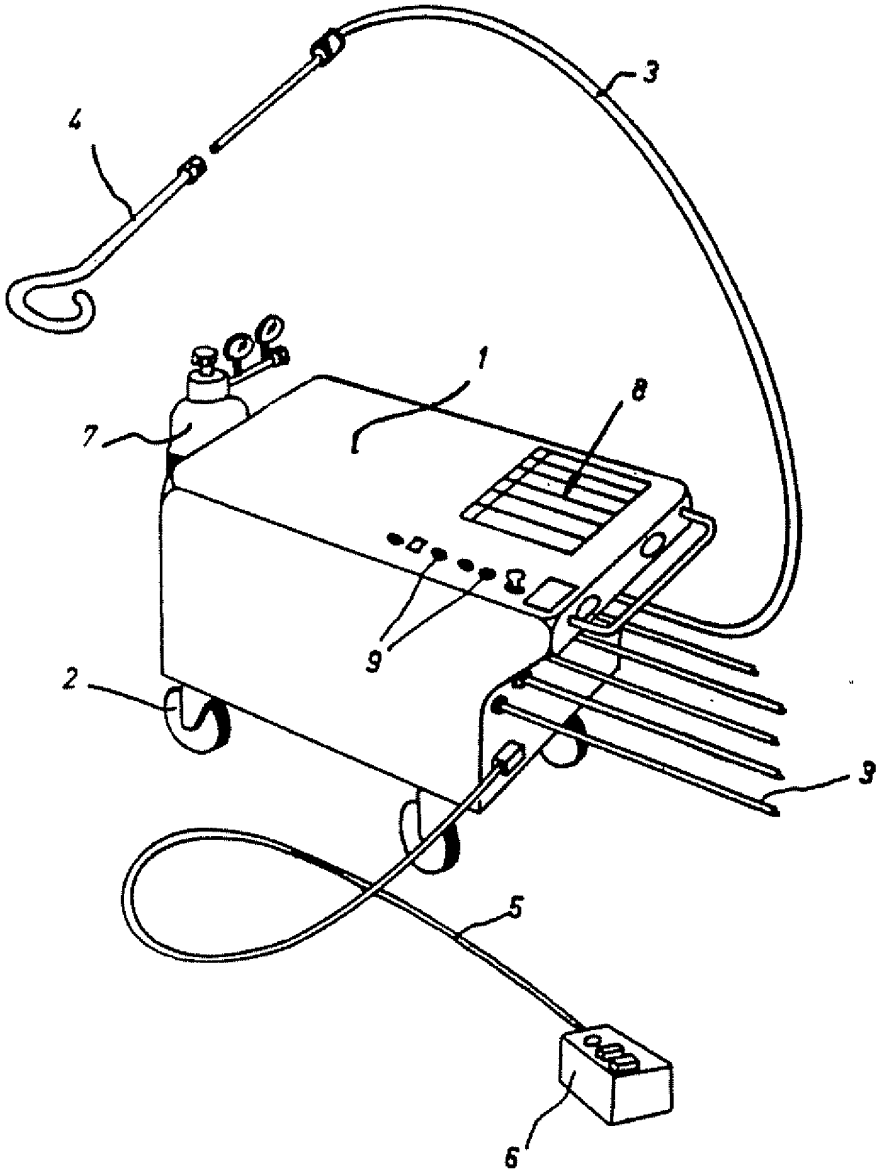
1,219,604 COMPLETE SPECIFICATION
2 SHEETS

This drawing is a reproduction of the Original on a reduced scale.
SHEET 1

FIG. 1



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COMPLETE SPECIFICATION

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SHEET 2

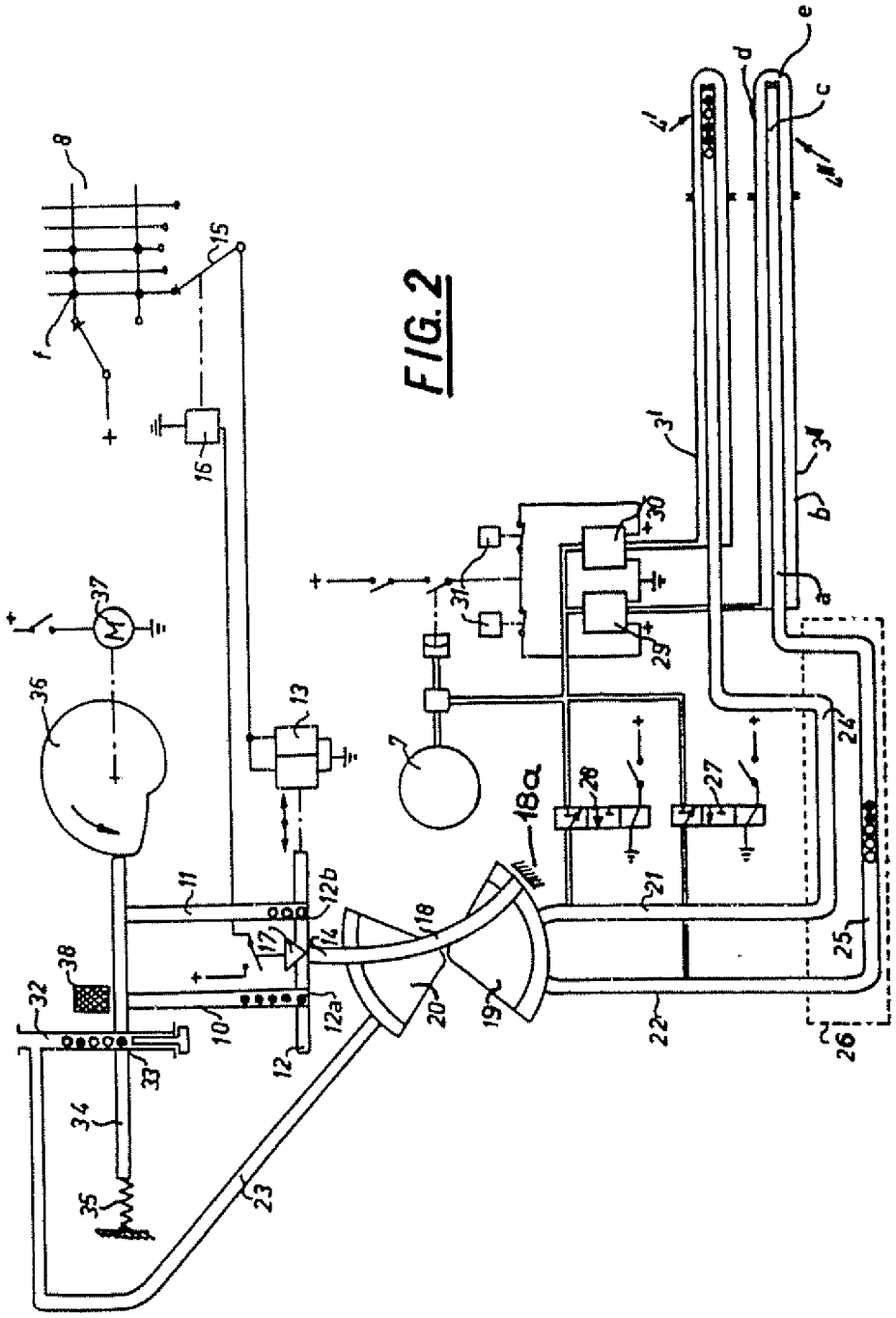

FIG. 2